

**CHEM 434 Bioinformatics
Syllabus
Spring 2009**

- Instructor:** Dr. Jamil Momand, Ph.D.
Dr. Nancy Warter-Perez, Ph.D.
- Class location and time:** Engineering and Technology, Room C256
T,R 1:30-3:10 PM
- J.M. Office Hours:** La Kretz Hall, Room 270
M 1-3, W 1-3, Th 9-10
Email: jmomand@calstatela.edu
Department phone: (323) 343-2300
Website: <http://www.calstatela.edu/faculty/jmomand/>
- N.W.-P. Office Hours:** Engineering and Technology, Room A305
T: 11 – 12:30 PM, R: 6:10 – 7:10 PM, or by appointment
Office Phone: (323) 343-5927
Email: nwarter@calstatela.edu
Department Phone: (323) 343-4470
- Course Prerequisite:** See the following website
<http://www.calstatela.edu/faculty/jmomand/PrerequisitesBioinformaticscourse.html>
- Required Text:**
- 1) Magnus Lie Hetland. (2008) Beginning Python: From Novice to Professional, 2nd Edition, Apress, ISBN 1-50059-982-9
 - 2) On-line bioinformatics manual-see
<http://www.calstatela.edu/faculty/jmomand/Bioinformaticscourse.html?Submit22=Bioinformatics+Course>
- References:**
- 1) Cristianini, N. and Hahn, M.W. (2007) Introduction to Computational Genomics: A Case Studies Approach. Cambridge University Press ISBN-13: 978-0521856034
 - 2) Claverie, J.M. and Notredame, C. (2006) Bioinformatics For Dummies, For Dummies Publisher, ISBN-13: 978-0470089859
 - 3) Pevsner, J. (2003) Bioinformatics and Functional Genomics, John Wiley & Sons, ISBN 0-471-21004-8
 - 4) Jones J. & Pevzner P. (2004), An Introduction to Bioinformatics Algorithms (Computational Molecular Biology), The MIT Press, ISBN 0262101068
 - 5) Dawson, M., (2003) Python Programming for the Absolute Beginner, Muska & Lipman/Premier-Trade; ISBN 1592000738

6) Lutz, M. & Ascher, D. (2004) Learning Python, O'Reilly Media Inc., ISBN 0-596-00281-5

7) Baxevanis & Ouellette (2001) Bioinformatics, Methods of Biochemical Analysis Series Vol. 43, John Wiley & Sons, ISBN 0-471-38391-0

8) Pevzner, P.A. (2000) Computational Molecular Biology, MIT Press, ISBN: 0262161974

9) Campbell & Heyer (2003) Discovering Genomics, Proteomics, & Bioinformatics, Pearson Education, ISBN: 0-8053-4722-4

10) Misener & Krawetz (2000) Bioinformatics Methods and Protocols, Methods in Molecular Biology Series Vol. 132, Humana Press, ISBN 089603-732-0

Final Projects due: Tuesday, 9 June, 1:30-4:00 PM

Grading:	Quizzes (3)	120 points
	Homework	80 points
	Final Project	200 points
	<u>Writing assignment</u>	<u>100 points</u>
	Total	500 points

Writing Assignment: The student will have the option completing one of two writing assignments. Option #1: write a 3-page minimum summary on any **primary research** article covering any topic in bioinformatics published within the last three months. In one's own words, the student will include a restatement of the hypothesis being tested, a summary of the results, and a conclusion of the work. Option #2: the student will write a four-page paper (minimum) that analyzes a company that utilizes bioinformatics to provide a service. **The company must offer a software program or access to a database service.** For either writing option, the student must obtain approval to write on the article/company from the instructor by April 23. **Writing projects are due 21 May, 1:30 PM.**

Programming assignment: The student will have a programming assignment that will be performed within a small group. The algorithm will be handed in as part of the final project. The group will introduce and demonstrate the algorithm to the entire class during finals week.

Make-up Quizzes and Homework Assignments: There are no make-up quizzes. There are no make-up homework assignments but the lowest homework score will be dropped.

Learning outcomes: To assist students gain the following skills:

- 1) Retrieve gene sequence information from Genbank
- 2) Use BLAST program to conduct gene similarity searches
- 3) Align multiple sequences with Clustal W program
- 4) Predict protein functional motifs secondary structures with PSIPRED
- 5) Display and compare three-dimensional structures of proteins
- 6) Write algorithms that will perform a search of gene sequences stored in a database
- 7) Understand the theory that led to the development of the scoring methods commonly used to measure sequence similarities

LECTURE SCHEDULE CHEM 434
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Lecture/ Instructor	Date	Topic	Reading	In Class Assignment	Homework
---	31 Mar	Holiday			
1 jm, nwp	2 Apr	Introduction to course; a primer on molecular life science	Introduction and Ch. 1 of online manual	Email to professors and introduce yourself. Give your previous biology, chemistry, programming and bioinformatics experience; indicate what you want out of the class.	Ch. 1 problems in online manual. Download NCBI news (Mar 2009). Print out and bring to 4/9 class.
2 nwp	7 Apr	Programming –Types and operations	Ch 1-4 BP	Write a Python script to compute the hydrophobicity of an amino acid.	
3 jm	9 Apr	How to get information on bioinformatics topics from CSULA, Medline, OMIM	Ch. 5-online manual	See calstatela.edu/faculty/jmomand/Bioinformaticscourse	See calstatela.edu/faculty/jmomand/Bioinformaticscourse
4 jm	14 Apr	Sliding window dot plots	Ch. 5-online manual	See calstatela.edu/faculty/jmomand/Bioinformaticscourse	See calstatela.edu/faculty/jmomand/Bioinformaticscourse
5 nwp	16 Apr	Python programming-if tests, while and for loops	Ch 5 BP	Write a sliding window program to compute %GC	Write a sliding window program to compute hydrophobicity
6 jm	21 Apr	Scoring matrices	Ch. 4-online manual	See calstatela.edu/faculty/jmomand/Bioinformaticscourse	See calstatela.edu/faculty/jmomand/Bioinformaticscourse
7 jm	23 Apr	Quiz 1 , Needleman-Wunsch algorithm, Smith-Waterman algorithm	Ch. 5-online manual	See calstatela.edu/faculty/jmomand/Bioinformaticscourse	See calstatela.edu/faculty/jmomand/Bioinformaticscourse
8 nwp	28 Apr	Python programming (cont.)		Given a globally aligned sequence, compute the score using fixed match/mismatch score and affine gap penalty	
9 jm	30 Apr	Information organization and sequence databases	Ch 2-online manual	See calstatela.edu/faculty/jmomand/Bioinformaticscourse	See calstatela.edu/faculty/jmomand/Bioinformaticscourse
10 jm	5 May	Quiz 2 , sequence comparison	Ch. 3-online manual	See calstatela.edu/faculty/jmomand/Bioinformaticscourse	See calstatela.edu/faculty/jmomand/Bioinformaticscourse
11 nwp	7 May	Python Programming-Functions and Modules	Ch 6, 10-11 BP	Write a program to write in a PAM matrix into a 2-dimensional array.	Write a program to compute the PAM/BLOSUM score of two amino acids.

12/jm	12 May	BLAST	Ch. 6-online manual	See calstatela.edu/faculty/jmomand/Bioinformaticscourse	See calstatela.edu/faculty/jmomand/Bioinformaticscourse
13/nwp	14 May	Longest Common Substring (LCS) Algorithm; dyanamic programming	LCS and Global Alignment handouts	Implement LCS algorithm-scoring	Final Project assignment
14/nwp	19 May	Global Alignment-Extensions to LCS		Implement LCS algorithm-traceback	
15/nwp	21 May	Writing report due, extensions to Global Alignment-Local Alignment, affine gap penalties	Local alignment handouts	Project help	
16/jm	26 May	PSI-PRED-prediction of protein structure, Protein Data Bank	Ch. 7-online manual	See calstatela.edu/faculty/jmomand/Bioinformaticscourse	See calstatela.edu/faculty/jmomand/Bioinformaticscourse
17/jm	28 May	Quiz 3 Predicting tertiary structure		See calstatela.edu/faculty/jmomand/Bioinformaticscourse	See calstatela.edu/faculty/jmomand/Bioinformaticscourse
18/np	2 Jun	Programming project help			
19/np, jm	4 Jun	Course summary, instructor evaluation, project help			
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